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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/800,950 | 03/15/2004 | William J. Park | 2003P19072US | 4450 |

28524 7590 05/09/2006

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| EXAMINER |
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JAWORSKI, FRANCIS J

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| ART UNIT | PAPER NUMBER |
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3768

DATE MAILED: 05/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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|------------------------------|--|------------------------------------|--|
| Office Action Summary | Application No. 10/800,950 | Applicant(s) PARK ET AL. | |
| | Examiner Jaworski Francis J. | Art Unit 3737 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 4/23,3/15/04.
- 2a) ☐ This action is FINAL.
- 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 - 31 is/are pending in the application.
 - 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 - 31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 March 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some * c) ☐ None of:
 - 1. ☐ Certified copies of the priority documents have been received.
 - 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>3/15, 4/23/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION***Specification***

The disclosure is objected to because of the following informalities:

Para [0001] copending case is still copending and has no Patent No.

Para [0047] It is believed that 120 and 124 are the respective cold and hot junctions of the thermoelectric cooler 122 such that in line 8 would read – cold junction 120 – with “120” deleted at end-line, and in line 12 would read – hot junction 124 – so that this Fig. 4 legend has mention, however there is latitude for alternative interpretation since para [0045] pages 13 – 14 bridging allows that ‘(thermal) coupling with’ is to be broadly construed. The intent here is to assure that the Peltier hot and cold junctions are appropriately labeled and so ‘124’ is accounted for.

Appropriate correction is required.

Drawings

The drawings are objected to because Fig. 3 element 30 legend typo -- THERMOELECTRIC --.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the

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remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

This application was reviewed for potential election of species regarding the various stated embodiments of paras [0047 –0057] however these were found to be usable together and not mutually exclusive under applicants' disclosure.

This application was also reviewed for potential obvious-type double-patenting conflict with pending parent case 10/183,302 however that application's pending claims 1 – 38 as filed 12/05/05 were found not in conflict insofar as this application's claims inter alia pertain to heat transfer structure and method associated with one or more electronic assemblies/sub-assemblies which are situated in the transducer housing interior.

Claim Rejections - 35 USC § 112/101

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

35 U.S.C. 101 reads as follows:

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Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 24 – 27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 24 inadvertently references claim 16 instead of 17 (or 18 etc. ?), 16 being an apparatus claim, and therefore the scope of the rejected claim set is unclear.

Claims 24 – 27 are also rejected under 35 USC 101 since they are, under reasonable interpretation not confined to a single statutory class as required by the statute.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

[Parenthesized claim numbers pertain to the specific claim or claims under rejection in the immediately preceding portion.]

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Claims 1 – 4, 11 – 12, 14, 30 - 31 are rejected under 35 U.S.C. 102(b) as being anticipated by Sliwa, Jr. et al (US5560362), of record in applicants' specification. Sliwa Jr. et al in Fig. 8 teaches structure of an ultrasound transducer comprising a housing 2, a transducer module 12, an electronics assembly of components located in the housing and coupled to the transducers and having an interior portion (central to the back-to-back axis of the transducers and their physical space), with the electronics assembly including a plurality of sub-assemblies comprised of discrete components 29, and first thermal conductor in the form of heat transfer fluid bag 31 thermally coupled to components 29 and operable to move heat from the interior as so defined to a second thermal conductor 15 further towards the exterior within the probe. (Claims 1, 2, 30) .

Since Sliwa Jr. et al states in col. 21 lines 17 – 20 that the heat transfer bag is usable with any of the active transfer embodiments disclosed, this is understood to pertain to the direct substitution of the Fig. 4 thermoelectric cooler 30 into contact with 15 as shown in Fig. 4, this thermoelement being inter alia of Peltier type, both 15 and 30 thereby comprising the 'second thermal conductor' see Sliwa, Jr. et al cols. 15 – 16 bridging. (Claims 3, 4, 31).

Since Sliwa Jr et al uses both heat pipes and cooling loops (Fig. 5 element 23 or Figs. 3d, 3e, respectively) the aforementioned statement of substitution extends to incorporation of the latter in association with the coolant transfer scheme of Fig. 8. (Claims 11 – 12).

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The transducer and electronics portions of Sliwa, Jr et al Fig. 8 are separated by at least the backing layer 11 which provides at least some thermal isolation. {This occurs inherently since no physical substance is a pure heat conductor or non-conductor}. (claim 14).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 5 – 9, 11 – 12, 14 – 15, 17 – 19, 21 – 22, 24 - 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sliwa, Jr. et al as argued against claim 2 supra, further in view of Kelly, Jr. et al (US5961465) alone or

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further in view of Matsumoto (JP 04336052 A, Abstract translation attached) or Cohen et al (US6445580).

Claim 10 is rejected under 35 USC 103(a) as being unpatentable only over the latter three-reference combinations..

Sliwa, Jr. et al taught that the thermoelectric cooler 30 could thermally couple to the transducer itself via Fig. 4 and the bulk of the patent's disclosure is directed to transducer heat transfer and not to electronic subassembly heat transfer, however if Sliwa, Jr. et al be viewed as alternative not additive vis-à-vis Fig. 4 vs 8 teachings, it would have none-the-less been obvious in view of Kelly, Jr. et al Figs. 7a – 7b to couple thermoelectric coolers 90, 92 to electronic subassembly components as well as to the transducer via solid thermal conductors since at least some heat would transfer due to the metallizations on flex circuit 18 which connects the transducer array to the electronic component subassemblies 22. In the alternative, Matsumoto (Abstract translation provided) teaches that a Peltier device 13 may draw off heat from the transducer array 11 via solid electrode layer 12a directly hence this renders obvious the modification of Kelly, Jr. et al to have thermoelements 90, 92 at least partially contact the flex circuit electrodes 18, as this variant would incorporate into Sliwa, Jr. et al.

In the alternative still, Cohen et al notes that in an analogous art concerned with high-density high power electronic component operations, i.e. small PCs and related devices, the prior art approach of direct compression heat transfer from subassembly 120 through Peltier device 110 to a heat sink 160 as in Fig. 1 may be relaxed in favor of a metallic heat conductive

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intermediate 220 (or like components in Figs. 3-4 thereof) to the thermoelement 240 and heat sink 250/vent 260 so that space efficiencies may prevail over the former, piggyback type association. In effect the latter evidences that the artisan considered 'contacting or closely thermally coupled' with respect to proximating an active cooling stage to the heat sources (transducer and/or electronic subassemblies) to be obvious alternatives in the trade-off between design packing efficiencies and heat transfer optimums, all the aforementioned involving solid thermal conductors in the metallization portions.. (Claims 5 – 6, 17-18, 24-26).

Both Sliwa, Jr. et al in col. 11 bottom and Kelly Jr. et al col. 4 top mention liquid thermal conductors as a variant for coupling to heat source components. (Claims 7, 27).

In any of the references, the conductors Sliwa Jr. et al 14 –or 15, Kelly Jr. et al 18, Matsumoto 12a, Cohen et al 230/460 are characterizable as sheets 'over' the heat source and heading exteriorly, with sheets 14 and 15 of Sliwa Jr. et al being thermally coupled. Additionally Sliwa Jr. et al advocate a thermal enhancement sheet 27 for augmented heat transfer, see Figs. 7b – 7d. (Claims 8, 9, 19). See also method claim arguments *infra*.

Since Matsumoto and Cohen et al evidence that flex circuits which serve as circuit boards at least in Kelly, Jr et al might be directly contacted by the active cooling device, it would have been obvious to do so in Sliwa, Jr. et al in order to augment the heat driven off. (Claim 10).

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Since Kelly Jr. et al similar to Sliwa Jr et al refers to heat pipe usage Figs. 5a – 5b or closed liquid cooling loop col. 6 top it would have been obvious to include same as the first thermal conductor as per Sliwa, Jr. et al teachings re Fig. 8. (Claims 11 – 12, 21 - 22).

Similar to the above anticipatory argument, the backing 16 of Kelly Jr. et al provides at least some transducer-electronic component thermal isolation. (Claims 14, 28).

In the above formulation both the cold and hot sides of the thermoelement would be aligned towards the transducer as well as along the circuit components. (Claims 1, 29).

Since the argument supra regarding claims 5-6 implicitly pertains to a methodology of cooling both the transducer array and the associated electronics via thermal conductor stages coupled to the electronics the corresponding method claim limitations are met. (Claims 17 – 18).

Claims 13, 20, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claim 12 immediately above, and further in view of Riggs (US3573557) since whereas the former are silent as to cooling loop embedding, it would have been obvious in view of the latter to embed, e.g. by etching a cooling loop for liquid Freon refrigerant, in order to efficiently draw off heat from a high speed operating printed circuit. (claims 13, 20).

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sliwa, Jr. et al as applied to claim 1 above, and further in view of *Dreschel

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(US6645145). Whereas the former is silent as to the substitution of micromechanical ultrasound transducers, it would have been obvious in view of the latter to incorporate same into in-body probes such as catheters or other small probes since these devices represent a smaller unit transducer, whereupon an active cooling device such as Sliwa Jr. et al would be required to prevent overheating, see col. 15 lines 35 – 39 of the latter.

The following additional art is cited as of interest:

Berke (US4672972) – Peltier thermoelement cooling for integrated circuits in MRI probe tip, see col. 5 lines 24 – 49.

Geitz (US6546080) - Peltier active heat exchange in miniature x-ray unit, see col. 4 bottom.

Young (US5307813) MRI in vivo microscopy using phase change material 9 controlled by Peltier element, see col. 3 top.

Tabuchi (JP 2005013461 A, of ineffective date, Abstract Translation attached) – Direct connection of active Peltier element to integrated circuit proximal to ultrasound array.

Adachi et al (US6443900) – Structure analog where Peltier element proximal to the ultrasound array controls impedance of substrate elements to change harmonic response of the transducer by heat application as opposed to heat carryoff, see col. 28 lines 43 – 65 and col. 28 lines 34 – 43.

Yamada (JP 10104211 A) – control of transducer array oscillation frequency by Peltier element heat application to alter vertical mode excitation

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response. [The Examiner believes that this is representative of the technology referenced in Adachi et al col. 26 lines 61 – 65.]

Toda (US5047637) – Scanning tunneling microscope technology wherein Peltier element 35 is thermally coupled to the STM sensor via metal high heat transfer layer 34 and incorporates into a thermal feedback loop using temperature sensor 37.

Any inquiry concerning this communication should be directed to Jaworski Francis J. at telephone number 571-272-4738.

FJJ:fjj

050306


Francis J. Jaworski
Primary Examiner